

A Method and Apparatus for Self-Propelled Cleaning

DESCRIPTION

BACKGROUND OF THE INVENTION

[Para 1] This invention relates generally to a method and apparatus for self-propelled cleaning. The present invention relates to a surface cleaner capable of collecting dirt, hair, common allergens and debris from a surface while moving by itself.

[Para 2] It is known that floor cleaners such as dry mops, stick and upright vacuum cleaners are used to remove dust and debris. While these cleaners may have been suitable for the purposes in which they were intended these bare floor cleaners do not allow for easy cleaning under furniture and have to be manually controlled.

[Para 3] It is also known that self-propelled bare floor cleaners exist with a drive unit and a separate frame onto which the cleaning element is attached. The aforementioned drive unit is inside and free in relation to the separate frame. The separate frame extends outward from the drive unit and is larger than the drive unit. The aforementioned drive unit is typically similar to that described in U.S. Patent No. 5,934,968, which discloses a hollow ball within which a driving mechanism is inserted to impart motion.

[Para 4] For example, U.S. Pat No. 6,571,415 to Gerber et al discloses a random motion drive unit housed in a separate cleaning frame with a dusting surface that contacts and cleans the parallel plane of the floor surface. Similarly, U.S. Patent Application 20030126701 discloses a random motion drive unit arranged inside a separate top-hat shaped frame with a duster attached to the underside of the frame and extending over the floor to clean only the floor surface.

[Para 5] These self-propelled cleaners work to clean in wide open spaces, however, there exists a need to make the cleaning device travel to smaller areas such as corners, drawers, underneath low furniture and the like for which the larger frame in the aforementioned cleaners does not allow. The larger frame of the aforementioned cleaners also prevents movement into areas where the opening into the area to be cleaned is smaller than the frame (i.e. a furniture post next to a wall). Accordingly, a need also exists for a device capable of greater range of motion and greater cleaning versatility.

[Para 6] Furthermore these self-propelled cleaners are constrained to cleaning only the surfaces parallel to one plane of the framework; thus restricting their ability to remove dust, hair, common allergens, debris and the like. This restriction does not allow cleaning in areas that have more than one surface such as corners, toe kicks, underside of furniture where debris and the like is more likely to collect.

[Para 7] It is therefore an object of the present invention to provide a smaller, more easily maneuverable, compact, cheaper self-propelled cleaner solution.

[Para 8] It is another object of the present invention to provide a self-propelled cleaning machine that makes it easy for singles, single parents and other individuals short on time to clean. The present invention provides an efficient method of cleaning that requires little or no human intervention.

[Para 9] It is a further object of the present invention to provide disabled persons and the elderly an easy to use self-propelled cleaning machine.

[Para 10] Still further, it is an object of the present invention to provide a self-propelled cleaner that can be propelled over, across, or underneath bare surfaces in hard to reach areas such as underneath furniture, in drawers, ductwork and the like.

SUMMARY OF THE INVENTION

[Para 11] The present invention advantageously fills the aforementioned deficiencies by providing a method and apparatus for self-propelled cleaning. The present invention utilizes a novel method and apparatus for overcoming the limitations of the present self-propelled cleaning tools. The present invention guides itself under furniture, in and out of corners, and around electrical cords requiring little or no human intervention. This is particularly advantageous to the elderly, disabled, singles, single parents or others who are limited in time or mobility. This solution may not completely replace the need for manual cleaning but is an important supplement to manual cleaning, and for some the present invention may indeed be a complete replacement for the need to perform manual cleaning.

[Para 12] One advantage of the present invention is that the cleaner will contact multiple surfaces rather than only the surface beneath it by touching surfaces that are both parallel and perpendicular to the cleaner. For example the present invention can simultaneously come in contact with three surfaces of a corner, while the current cleaning tools are constrained to cleaning only one surface of a corner namely the floor. Another example is when the present invention is in close proximity to the bottom-side of furniture, thereby, allowing contact with both the bottom-side of the furniture and the surface on which the furniture rests (above and below the self-propelled cleaner).

[Para 13] In addition, in one embodiment of the present invention a cleaning sheet directly surrounds the drive unit allowing the overall footprint of the self-propelled cleaner to remain close to the size of the drive unit (i.e. no outward extension or frame). This allows for greater maneuverability particularly into and out of corners or small spaces such as drawers, duct work, closets, and the like. This small footprint provides a benefit by reaching areas that cannot otherwise be reached by the current self-propelled cleaners.

[Para 14] In the preferred embodiment of the present invention a cleaning sheet is formed into an envelope through stitching, which results in a mostly encompassed drive unit. Therefore the envelope substantially surrounds the drive unit allowing the drive unit to be inserted into and removed from the

envelope. The drive unit is spherically shaped, like a ball, and moves simultaneously with the envelope. The drive unit is activated/deactivated by a switch that is located on the drive unit.

[Para 15] In other embodiments of the present invention the cleaning sheet can be formed into an envelope via adhesives or other bonding methods provided it contains the drive unit therein and allows for insertion and removal of the drive unit. In yet another embodiment the envelope has an elastic lined opening so as to snugly contain the drive unit.

[Para 16] In another embodiment of the present invention the envelope is substantially larger than the drive unit allowing one or more drive units to fit within the envelope or allowing one or more drive units to move freely within the envelope imparting motion on the overall envelope across the surface to be cleaned and allowing for greater surface area coverage.

[Para 17] In another embodiment of the present invention the envelope can consist of one or more materials with different characteristics. For example, the envelope can be made by combining plastic in the shape of a cone and a cleaning sheet, whereby, the drive unit is contained. Another example is an envelope that is both cardboard, shaped as a box, and a cleaning sheet containing the drive unit. Furthermore, in additional embodiments of the present invention the envelope can be made into various shapes. For example circular, cone-like, or rectangular.

[Para 18] In the preferred embodiment of the present invention the cleaning sheet is a disposable dry electrostatic cloth that substantially encompasses the drive unit. In other embodiments the cleaning sheet can be laundered and re-used. In yet another embodiment a scented cleaning sheet delivers a scent incident to the motion of the drive unit.

[Para 19] In an alternate embodiment of the present invention the cleaning sheet possesses one or more appendages protruding from the outer surface of the cleaning sheet. These appendages can be of similar or dissimilar material to that of the sheet. In yet a different embodiment the cleaning sheet is an appendage that is attached to the drive unit. This appendage trails the drive

unit and collects dirt and debris. Additionally, more than one cleaning sheet or appendage can be attached.

[Para 20] In another embodiment of the present invention the cleaning sheet is wetted with a cleaning/polishing agent such as ammonia, borax, sodium bicarbonate, sodium hypo chlorite, sodium hydroxide, water, detergents, lemon oil, pine oil, solvents, surfactants, or antimicrobial.

[Para 21] In the preferred embodiment of the present invention the drive unit is spherical in shape. In other embodiments the drive unit can be various shapes such as cylindrical or elliptical; all shapes allow motion across a surface. Furthermore the drive unit size is small enough to fit in tight spaces such as between a wall and the leg of a piece of furniture. In another embodiment of the present invention the drive unit is sufficiently sized to effectively clean larger spaces. For example, a drive unit the size of a beach ball can clean a large arena that has few obstacles.

[Para 22] In the preferred embodiment of the present invention the drive unit shell is made of a rigid plastic material. In other embodiments the drive unit shell can be multi-faceted, solid, or wiffle-like. The outermost surface of the drive unit can be made of rubber and be smooth or textured in nature. Furthermore the shell's outer surface can be electro-statically charged or coated with an adhesive.

[Para 23] In the preferred embodiment of the present invention the construction of the drive unit shell and motorized mechanism are separate elements but joined as one. The drive unit shell and motorized mechanism are sufficient in mass thus providing momentum for forward and random motion. This motion prevents the self-propelled cleaner from stopping or getting stuck. In another embodiment the drive unit shell and motorized mechanism are monolithic. In yet another embodiment the drive unit shell and motorized mechanism contain additional elements such as a vacuum or additional cleaning sheets.

[Para 24] In the preferred embodiment the self-propelled cleaner moves independently about the surface to be cleaned. In an alternate embodiment of the present invention the motion of the drive unit is controlled remotely,

whereby, the controller can be human or machine. For example a base station could control the time, range, and area cleaned by the self-propelled cleaner.

[Para 25] In other embodiments of the present invention the drive unit is activated/ deactivated by a remotely controlled switch or by removing/inserting the drive unit into a docking station or recharging station. In yet another embodiment the drive unit is activated/deactivated at certain time intervals through the use of a clock chip or other timing device.

[Para 26] In the preferred embodiment rechargeable batteries power the drive unit. In other embodiments disposable batteries, solar power, kinetic energy (such as wind-up), or a fuel cell power the drive unit.

[Para 27] In the preferred embodiment of the present invention one or more cleaning sheets and a stitched seam form an envelope that can be removeably attached to the drive unit. This envelope or sheet assembly snugly encompasses the drive unit. Thus the drive unit and cleaning sheet move simultaneously.

[Para 28] In alternate embodiments other means to fasten the cleaning sheet to the drive unit can be used such as hook and loop, adhesives, buttons, tape, snaps, glue, rubber, rope, string, magnetic seal, elastic bands, tacks and the like.

[Para 29] In an alternate embodiment a formed sheet is made such that it does not require a fastener, connector, or adhesive layer to operatively move with the drive unit. Such a formed sheet is constructed in a manner that it can expand to be placed over the drive unit and contract for a snug fit to the drive unit. Any such process that can produce the desired shape and fit may be used. For example the formed sheet can be stamped, sewn or constructed into shape. One novel construction would involve the use of heat shrink material woven into the cleaning sheet forming the desired shape around the drive unit when heat is applied.

[Para 30] In another embodiment the outer shell of the drive unit facilitates the fastening of the cleaning sheet to the drive unit. For example, the drive

unit shell can incorporate adhesives, rubber, hook and loop or other features. In yet another embodiment attachment structures can be incorporated into the shell of the drive unit to receive and retain the cleaning sheet.

[Para 31] In another embodiment of the present invention the cleaning sheet is woven with a magnetic material and magnetically attached to the drive unit whose shell if made of a magnetic material. In yet another embodiment of the present invention the cleaning sheet is removably attached to the drive unit by an external semi-rigid skeletal clip that emulates the shape of the drive unit.

[Para 32] In another embodiment of the present invention the cleaning sheet and shell of the drive unit are one entity. The cleaning sheets are layered on top of each other such that one cleaning sheet is peeled off or removed and another cleaning sheet is revealed beneath it. In an alternate approach multiple cleaning sheets are contained within the shell of the drive unit. An opening in the shell of the drive unit allows for a cleaning sheet to be extracted from the shell of the drive unit.

[Para 33] In another embodiment of the present invention the sheet is made of a durable material such as rubber, fur, leather and the like. The random motion of the drive unit motivates pets or children to chase and engage in play with the present invention as a toy. The durable sheet material provides longevity and withstands rough handling such as teeth marks, clawing, and the like. In this embodiment sensors and indicators can be included to detect and indicate impeded motion, low battery power, location, or other useful information.

[Para 34] The present invention will be more fully understood from the accompanying drawings that are intended to be read in conjunction with the description and preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

[Para 35] While the specification concludes with claims particularly pointing out and distinctly claiming the invention, it is believed that the present

invention will be better understood from the following description taken in conjunction with the accompanying drawings in which:

[Para 36] FIG. 1 is a perspective view of the self-propelled cleaner according to the present invention.

[Para 37] FIG. 2 shows the self-propelled cleaner in use.

[Para 38] FIG. 3A is a view of an alternate embodiment of the self-propelled cleaner in use.

[Para 39] FIG. 3B is yet another view of an alternate embodiment of the self-propelled cleaner in use.

[Para 40] FIG. 4A through 4D are partial cross sectional views of the self-propelled cleaner.

[Para 41] FIG. 5 is a perspective view showing the self-propelled cleaner simultaneously in contact with three surfaces.

[Para 42] FIG.s 6A, 6B and 6C show alternate shapes of the self-propelled cleaner.

[Para 43] FIG. 7 is a view of an alternate embodiment of the present invention in use as a toy.

DETAILED DESCRIPTION OF THE INVENTION

[Para 44] A self-propelled cleaner 1 is illustrated by way of example in FIG. 1. The self-propelled cleaner 1 is comprised of a drive unit 2 and a sheet assembly 24. The sheet assembly 24 is formed with one or more sheets 4 and one or more fasteners 6. The sheet assembly 24 is formed to substantially encompass and fit snugly around the drive unit 2. The sheet 4 is preferably an electrostatic cloth but may consist of any sheet such as but not limited to an adhesive sheet or a sheet created by an electric field. The fastener 6 is preferably a stitched seam but may consist of any fastener such as but not limited to hook and loop, buttons, glue and the like. An opening 20 in the sheet assembly 24 allows access for inserting and removing the drive unit 2.

The opening 20 also allows the user to activate and deactivate the drive unit 2 with an on/off switch 8.

[Para 45] The preferred embodiment of and method of using the self-propelled cleaner 1 of the present invention is shown in motion in FIG. 2. The self-propelled cleaner 1 is propelled across a surface by the drive unit 2. The fastener 6 ensures that the sheet 4 is operatively connected as a sheet assembly 24 to the drive unit 2. As the drive unit 2 rotates across the surface the sheet assembly 24 gathers debris 10.

[Para 46] In FIG. 3A the self-propelled cleaner 1 is shown in motion with an alternate embodiment of the sheet assembly 24. A drive unit 2 is shown surrounded loosely by a sheet assembly 24. In FIG 3A one drive unit 2 is shown, however, the sheet assembly 24 can contain more than one drive units. The drive unit 2 propels the sheet assembly 24 across the surface to gather debris 10.

[Para 47] Turning now to FIG. 3B, an alternate embodiment of the sheet assembly 24 is shown. In this figure, the sheet assembly 24 is formed with one or more sheets 4 and one or more fasteners 6. The sheet assembly 24 fully encompasses and is operatively connected to the drive unit 2.

[Para 48] Continuing to view FIG. 3B, the sheet 4 may have a single appendage 12 or a plurality of appendages 12 that extend outward from the outer surface of the sheet assembly 24. The appendage(s) 12 may extend in myriad lengths, widths and can be flexible or semi-rigid. The appendage 12 material can be similar to the sheet 4 or dissimilar. For example, the appendage(s) 12 can be strips of tape, rubber or any other material while the sheet 4 can be an electrostatic cloth. The sheet assembly 24 and appendage(s) 12 gather debris 10 as the drive unit 2 propels the self-propelled cleaner 1 across the surface.

[Para 49] FIG. 4 provides expanded partial cross sectional views of the relationship of the drive unit 2 to the sheet 4 or sheet assembly 24.

[Para 50] In the preferred embodiment of the present invention shown in FIG. 4A, the fastener 6 is shown as a seam, thereby allowing one or more sheets 4 to form a sheet assembly 24. The sheet assembly 24 is formed to substantially encompass and fit snugly around the drive unit 2. The fastener 6 can be a stitched seam, a glue bond, and the like. This fastener 6 can be a continuous or non-continuous connector. For example multiple staples can create a non-continuous seam. Furthermore FIG 4A illustrates that the fastener 6 is a member of the sheet assembly 24 and does not directly connect the sheet 4 to the outer surface of the drive unit 2.

[Para 51] Alternatively FIG 4B illustrates the sheet 4 directly connected to the drive unit 2 with connector(s) 26. The connector(s) 26 are shown in multiple locations on the outer surface 30 of the drive unit 2. The connector(s) 26 may cover the outer surface 30 of the drive unit 2 partially or entirely. These connector(s) 26 can be hook and loop, adhesive, double sided tape, rubber, or other material to facilitate connection of the sheet 4 to the drive unit 2.

[Para 52] Moving to FIG. 4C, this figure shows a formed sheet 28 next to the outer surface 30 of the drive unit 2. There may be space between this formed sheet 28 and the drive unit 2 as shown in FIG 4C or there could be direct contact between the formed sheet 28 and the drive unit 2. The construction of the formed sheet 28 is such that it operatively moves with the drive unit 2 without needing the elements shown in other figures such as a fastener 6, connector(s) 26, or adhesive layer 22. One such example of a formed sheet 28 would closely resemble that of a knitted hat or headband.

[Para 53] FIG 4D illustrates a sheet 4 connected via an adhesive layer 22 to the outer surface 30 of the drive unit 2. The adhesive layer 22 may cover the outer surface 30 of the drive unit 2 partially or entirely. Furthermore the adhesive layer 22 may be a material or mechanical feature built directly into the outer surface 30 of the drive unit 2. This adhesive layer 22 can be glue, rubber, magnetic material, micro fingers, and the like that adheres the sheet 4 to the drive unit 2.

[Para 54] FIG. 5 illustrates the sheet assembly 24 of the self-propelled cleaner 1 in simultaneous contact with multiple surfaces A, B and C to facilitate

maximum collection of debris, dirt, hair and the like. Additionally, while in operation, the drive unit 2 can travel along intersection AC or BC bringing the sheet assembly 24 in direct simultaneous contact with two surfaces.

[Para 55] FIG. 6A shows the preferred embodiment of the present invention where the drive unit 2 of the self-propelled cleaner 1 is spherical. In FIG. 6B and FIG. 6C, alternate embodiments of the self-propelled cleaner 1 are illustrated. FIG. 6B shows an alternate embodiment where the drive unit 2 is elliptical. Furthermore FIG. 6C shows yet another alternate embodiment where the drive unit 2 is cylindrical. All of the drive unit 2 shapes in FIG 6 facilitate movement across a surface.

[Para 56] In FIG. 7 an alternative embodiment of the present invention 1 is shown as a toy in pursuit by an animal 32. In this embodiment the sheet assembly 24 is made of fur. The drive unit 2 is shown substantially surrounded by the sheet assembly 24. The drive unit 2 propels the sheet assembly 24 across the surface to motivate the animal to chase and engage in play.

CONCLUSION RAMIFICATIONS AND SCOPE OF THE INVENTION

[Para 57] From the aforementioned description and drawings, a number of advantages of the self-propelled cleaner become evident:

- (1) Little or no human intervention is required allowing the self-propelled cleaner to clean a surface while the user is free to do something else.
- (2) The self-propelled cleaner has the ability to clean areas that are normally out of reach such as underneath furniture.
- (3) Helps eliminate dust, dirt, hair and common allergens from surfaces.
- (4) Multiple surfaces are cleaned as the self-propelled cleaner contacts and collects dirt and hair that gather in corners or against walls. A

traditional dry mop, stick or upright vacuum cleaner and other cleaners cannot accomplish this.

- (5) Ideal for use where access is limited and in small or large areas. Examples where access is limited include the space between a washer and dryer. Examples of small or large areas include drawers, ducts, and floor surfaces.

[Para 58] With respect to the above description, it is to be realized that the optimum dimensional relationships for the parts of the invention, to include variations on size, materials, shape, form, function and manner of operations, assembly and use, are deemed readily apparent and obvious to one skilled in the art. All equivalent relationships to those illustrated in the drawings and described in the specification are intended to be encompassed by the present invention.

[Para 59] Therefore, the foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction, embodiments and/or operation(s) shown and described. Accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

[Para 60] While the present invention has been described above in terms of specific embodiments, it is to be understood that the invention is not limited to these disclosed embodiments. Variations are possible within the teachings of the present invention. The scope of the invention should be determined by proper interpretation and construction of the appended claims and their legal equivalents.